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REVIEW

Advancing the role of the pharmacy technician: A systematic review

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ABSTRACT

Objectives: To summarize the findings of a literature search on advancing the role of pharmacy technicians, including the types of training identified and the potential costs and benefits to both the technician and the pharmacy.

Data sources: A literature search of Scopus, Embase, and Medline was conducted on January 11, 2017.

Study selection: Original research, research reports, case studies, or association reports were included for review. Articles were considered to be relevant based on identification of an advanced pharmacy technician role or addressing additional training/education for technician functions.

Data extraction: A standard data extraction form was used to collect study authors, article title, year published, journal title, study design, brief description of methods, primary outcome measures, advanced technician roles identified, additional education or training addressed, and additional costs and benefits identified in each article.

Results: A total of 33 articles were included for full review and data extraction. Study design varied, with 17 (52%) quantitative, 1 (3%) qualitative, 5 (15%) mixed-method, and 10 (30%) case study designs. Seventeen (52%) of the studies included were published after 2006. The mechanism of training was primarily through supervised on-the-job training, allowing technicians to assume administrative-based positions that facilitated a pharmacist-led clinical service, with either the pharmacist or the pharmacy receiving the greatest benefits.

Conclusion: Although the literature supports technicians performing advanced roles in the pharmacy, resulting in either improved patient outcomes or opportunities for pharmacists to engage in additional clinical services, the benefits to the technician were primarily indirect, such as an increase in job satisfaction or a more desirable work schedule. If a technician is to take on additional roles that require completion of a formalized training or educational program, benefits that are more tangible may help to inspire technicians to pursue these roles.

Both the American Society of Health-System Pharmacists (ASHP) and the American Pharmacists Association (APhA) have supported the standardization of education, training, and certification requirements for entry-level pharmacy technicians, including completion of a training program accredited by ASHP and the Accreditation Council for Pharmacy Education and national certification through the Pharmacy Technician Certification Board (PTCB).[1,2] The ASHP statement further delineates among the competencies of an entry-level technician and acknowledges that with additional training, technicians can take on advanced roles.[1] These advanced roles include "tech-check-tech," purchasing or fiscal management, supervisory positions, assistance with medication history, medication therapy management, immunizations, quality improvement, hazardous drug handling, patient assistance programs, education and training, community outreach, drug use evaluation, adverse drug event monitoring, industry, and informatics.[1] ASHP states that there may be additional opportunities for advanced roles not included in this list. However, training components to prepare technicians for these roles is yet to be defined.

In 2010, ASHP held the Pharmacy Practice Model Initiative (PPMI) with the goal to "advance the health and well-being of

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Key Points

Background:

- After completing an advanced training program, few national pharmacy organizations have clear and supportive policies on the use of pharmacy technicians in novel positions both inside and outside of the pharmacy.
- The costs and benefits of advancing the pharmacy technician are not defined.

Findings:

- Thirty-three articles were included that evaluated the use of pharmacy technicians in an advanced role and identified the training required and subsequent costs and benefits obtained from using technicians in this role.
- The mechanism of training was primarily through supervised on-the-job training, allowing technicians to assume administrative-based positions that facilitated a pharmacist-led clinical service, with either the pharmacist or the pharmacy receiving the greatest benefits.

patients by developing and disseminating a futuristic practice model that supports the most effective use of pharmacists as direct patient care providers."[3] Participants in the PPMI agreed that "pharmacy technicians could be used more extensively to free pharmacists from drug distribution activities."[3] To successfully implement and maintain these new services, attention has been focused on the advancement of technicians and how they can offset the dispensing responsibilities of pharmacists and assist in the facilitation of these services. As a result of the PPMI, in 2013 the PTCB set new requirements to be implemented in 2020 that would require all technicians wishing to obtain certification to complete a training program accredited by the Pharmacy Technician Accreditation Commission before being eligible for the examination.[4] The implementation of this requirement was suspended in 2017, citing the need for additional research and deliberation.[5]

Although there is support from national organizations for the advancement of technicians, the primary focus remains on creating an environment that allows pharmacists to practice at the top of their licenses. The realization that the role of the technician must evolve for this to happen appears to be an afterthought. The ASHP and APhA statements define the role of the technician in terms of an "aid to the pharmacist in providing optimal patient care"[1] or "assisting the pharmacist with the delivery of patient care."[2] With technicians defined as support staff and the advocacy for their advancement merely to facilitate the progression of the role of the pharmacist, the question remains as to who is the beneficiary from the advancement of technicians. If additional training is needed to prepare technicians for advanced roles, the scope and cost of this training as well as the benefits gained from advancing the role of the technician must be defined.

Objective

The objective of this literature search was to summarize the findings of advancing the role of pharmacy technicians, including the types of training identified and the potential costs and benefits to both the technician and the pharmacy.

Methods

Search strategy

A literature search was conducted using Scopus, Embase, and Medline, including any date through January 11, 2017. The search included a combination of "pharmacy technician" OR "pharmacy technologist" AND "education" OR "training." The search was limited to peer-reviewed articles and reviews published in English. Search results from each database were exported to Microsoft Excel, merged, and sorted for removal of duplicate citations.

Study selection

Original research, research reports, case studies, and association reports were included for review. Viewpoints or commentary papers were excluded. Articles were considered to be relevant based on identification of an advanced pharmacy technician role or addressing additional training/education for technician functions. Initial screening of all abstracts and titles was conducted independently by both authors to determine whether to include or exclude based on selection criteria. During the abstract and title screening phase, an a priori level of agreement on inclusion/exclusion was set at 80%. All screening disagreements were reconciled through discussion before moving to full-text review. Full-text articles were assessed for inclusion, and reasons were documented for all excluded papers.

Data extraction

A standard data extraction form was used to collect study authors, article title, year published, journal title, study design, brief description of methods, primary outcome measures, advanced technician roles identified, additional education or training addressed, and additional cost and benefits identified in each article regardless of economic perspective used. Study design was operationalized as a categoric variable, and each article was determined to be either a quantitative, qualitative, mixed-methods, or case study.

Results

A total of 785 records were identified through database searches, resulting in a total of 549 unique articles after duplicates were removed (Figure 1). Agreement was reached independently for 507 out of 549 articles (92%) concerning inclusion/exclusion based on abstract and title screening. Disagreements were discussed until full agreement was reached, resulting in 27 (55%) of the 42 articles added to full-text review. During abstract screening, 347 (63%) of the articles were excluded owing to lack of relevance to pharmacy

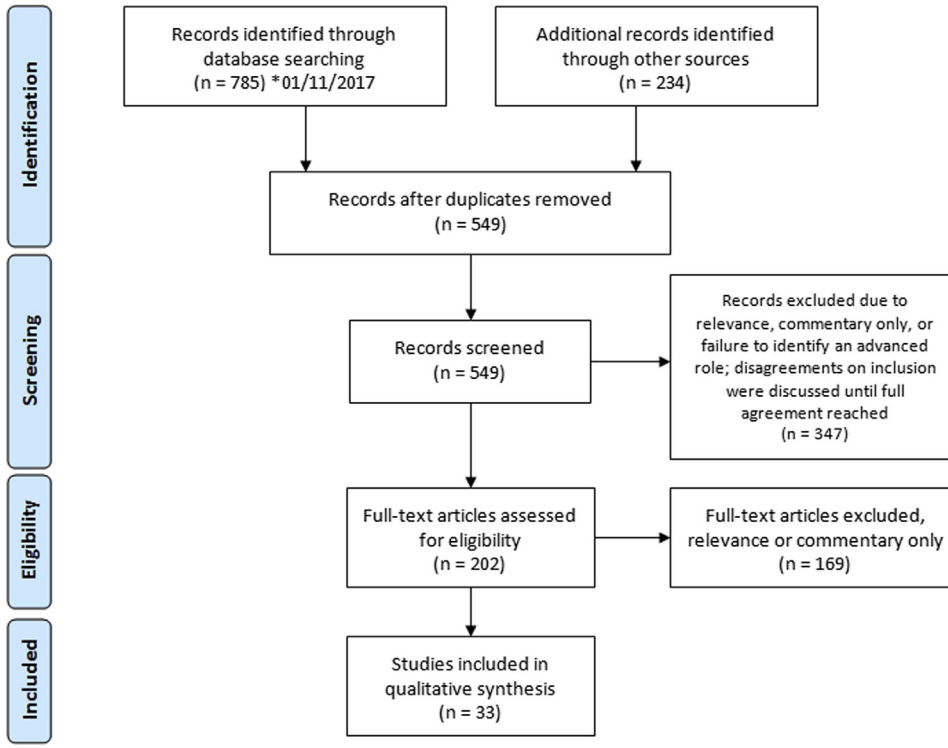

Figure 1. Summary of literature screening and selection (PRISMA 2009 flow diagram).

technicians, being commentary only, or failure to identify an advanced role or added education/training for technicians.

Of the 202 articles remaining, an additional 169 (84%) were excluded during full-text review owing to lack of relevance to advanced pharmacy technicians or technician education/training (86/167) or being commentary only (83/169). A total of 33 articles were included for full review and data extraction. Study design varied, with 17 (52%) quantitative, 1 (3%) qualitative, 5 (15%) mixed-method, and 10 (30%) case study designs.[6-38] Seventeen (52%) of the studies included were published after 2006. Thirty-two (97%) of the articles included were published in journals with a primary audience of pharmacy practitioners, with the only nonpharmacy journal being the *British Journal of Cancer*.

Various advanced roles for pharmacy technicians identified through the review include increased administrative, clinical, dispensing, or leadership responsibilities. Nineteen articles (58%) identified administrative roles, 15 (45%) identified clinical roles, 12 (36%) identified dispensing roles, and 3 (9%) identified leadership roles. Sixteen articles (48%) identified more than 1 advanced role, with 4 (25%) identifying administrative, clinical, and dispensing roles, 7 (44%) identifying administrative and clinical roles, 2 (13%) identifying administrative and dispensing roles, 2 (13%) identifying administrative and leadership roles, and 1 (6%) identifying administrative, dispensing, and leadership roles.

Six training mechanisms were identified. Of these, 3 were baseline qualifications that a technician must have to be considered for the role. Nine articles (27%) required certification, 8 (24%) required a minimum amount of work experience, and 10 (30%) required previous training. The remaining 3 training mechanisms included informal on-the-job training led by the pharmacists or other technicians, formal technician training programs by and apart from the employer, and test-based certification to demonstrate competency after education. Twenty (61%) required a formal training program, 19 (58%) required an informal on-the-job training program, and 12 (36%) required test-based certification. The majority of the articles, 21 (64%), required a combination of training mechanisms.

Both direct and indirect costs and benefits were identified in 27 articles (82%). Direct and indirect costs included the time for both the technician and the educator to complete the training (2 [7%]), supplies included in the training (4 [15%]), and the cost to cover routine operations in the pharmacy during the training when appropriate (2 [7%]). Indirect benefits to the organization of advancing technician roles and responsibilities were identified as cost savings through potential elimination of pharmacist positions (4 [15%]), increase in potential revenue through expanded clinical services (9 [33%]) and improved efficiency (9 [33%]), improved patient adherence (3 [11%]), and improved satisfaction from other departments (2 [7%]) and patients (7 [26%]) in pharmacy services. Direct and indirect benefits to the pharmacist and technician were identified throughout, such as increases in technician wages (7 [26%]), improved job satisfaction for technicians (6 [22%]) and pharmacists (2 [7%]), a stronger career ladder for technicians (3 [11%]), and an increase in confidence of the technician in their knowledge and ability to perform a particular skill (4 [15%]; Table 1).

Table 1
Qualitative data extracted from all included studies

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
Schafheutle EI, Jee SD, Willis SC	2017	Mixed methods	Fitness for purpose of tech education and training in U.K.	Pharmacy technician in Great Britain	2 years' work experience in either community or hospital; knowledge-based and competency-based qualifications	Higher salary for technicians after training; higher salary for technicians in hospital compared with community
Bailey JE, Surbhi S, Bell PC, Jones AM, et al.	2016	Case study	Describe the design, implementation, and experience using technicians to improve transitions of care	Assist in medication review and obtaining accurate admission med list in hospital; reinforce medication-related education; identify potential social barriers to discharge; develop specific plans for patients to obtain discharge meds within 24 hours of discharge; schedule home visits and make reminder calls; perform medication reconciliation and identify potential DTPs; provide follow-up documentation to pharmacist; contact pharmacist for emergencies; conduct 2nd home visit; make support session reminder calls and help arrange transportation; attend support sessions and encourage patient participation; schedule CMR visits and reminder calls; assist Medicaid patients in maximizing drug plan coverage; assist physicians in obtaining prior authorization; help patients identify and use least expensive pharmacy	Certified; health system–specific training: health system personnel; program-specific training (didactic and interactive): faculty and staff and program pharmacists; patient communication and motivational interviewing; medication history training; appropriate drug disposal practices; basic disease management (signs/symptoms of adverse drug events and worsening condition); safety planning training for home visits; formal online assessments; follow-up discussion and role playing to assess knowledge, understanding, and skills; on-the-job training: program pharmacists	Allow techs to perform at the top of their license; positive trends in all key process measures over time; positive trend in home visit completion rate after discharge; high home visit completion rate; positive trend in phone follow-up completion rate; identify potential DTPs at home visits for 84.9% of patients; coordinated targeted MTM by pharmacists for 104 patients; positive trend in number of targeted MTM contacts; coordinated outpatient CMRs for 33% of patients; positive trend in number of outpatient CMRs conducted by pharmacist; positive trend in number of participants scheduled for support sessions
Evans JL, Gladd EM, Gonzalez AC, Tranam S, et al.	2016	Case study	Describe the creation of a clinical pharmacy technician	Manage pharmacists' schedule (appointment template, scheduling, managing cancellations); manage consultations (review referral, determining priority, scheduling appointment); gather metric data and generate reports; communicate clinical pharmacy announcements; coordinate clinical pharmacist peer review process; contact patients via phone to provide education about proper medication administration, storage	4 months (on-the-job supervision, interactive mock patient scenarios, and written exams); certified; orientation to clinical pharmacy services; creation of clinical pharmacist schedules; appropriate consultation review and appointment scheduling; method for prioritizing patient care; triage or transfer of care (pharmacist or provider issue); basic familiarity with disease states managed by pharmacist; review of high-risk meds; appropriate patient communication skills;	Improved efficiency and productivity of pharmacist and increase in volume of patient care provided by pharmacy team; initial 3 months (only 1 tech): pharmacist could devote an additional 10–15 hours each month to clinical services, increase in number of pharmacist-completed encounters (240–290) per month, completed an average of 90 phone encounters each month to provide education to patients; with addition of 2nd tech: offset 104.3 hours of pharmacist time, patients were

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Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
				and disposal, and chart review of Rx dispensing history and documentation in medical record; communicate with other health care providers to coordinate pharmacy care and notify of completed consults; assist with drug information inquiries; prepare educational materials for patients and health care providers; assist with data collection	EHR documentation; data collection and reporting; competency assessment	contacted within 48 hours of receiving referral to schedule appointment, increase from 41% of referrals resulting in completed patient encounter to 56%, decrease from 22.6 days average to complete encounter to 10.3 days, completed an average of 193 phone encounters each month to provide education
Gilbert EM, Gerzenshtein L	2016	Case study	Describe the services offered and the roles of the pharmacist, students, and technicians	Developed the role of "patient care advocate" for pharmacy technicians; help to overcome insurance and payment barriers; "own" a disease state; monthly refill calls; adherence reminder calls	Certified; on-the-job training for navigating the patient's health record; filling out and providing clinical information on prior authorization forms; collaborating with specialty pharmacists on insurance appeal submissions; find disease-specific patient copay assistance; "become familiar with therapies associated with treating these specific disease states"	In 18 months, patient care advocates obtained >$700,000 in patient assistance; provide "seamless flow of medication management services"
Justis L, Crain J, Marchetti ML, Hohmeier KC	2016	Quantitative	Effect of pharmacy technicians on industry standard adherence performance measures (Star ratings)	Role in cognitive pharmaceutical services, including MTM and adherence coaching; support tasks	Classroom training for the 3 MTM platforms used; web-based training activities for these platforms; hands-on in-store training	56% of sites improved in diabetes PDC (originally only 7/16 had a 4-star score); 100% of sites achieved a 5-star score for cholesterol (originally 14/16 were 5-star, other 2 were 4-star); 100% of sites had a 5-star score for RASA measure (originally 16/16 were 5-star); 56% of sites improved in score
Shireman TI, Svarstad BL	2016	Quantitative	Effectiveness and sustainability of a protocol using pharmacists, technicians, and novel tools for adherence and BP control in uncontrolled hypertensive patients	Calling and reminding patients; printing Rx profiles; setting up table and chairs; using an automatic monitor to measure BPs; administering patient self-report tools	8 hours of training (1 h self-study, 7 h joint workshop); assist the pharmacists in making and confirming appointments; setting up a semiprivate BP counseling station; measuring BPs; collecting previsit tools completed by patients	30 minutes of tech time per completed visit at $13.01/h; 95.4 minutes per patient of tech time over 6 months; $104.80 per patient for pharmacist, tech, and tools used; $22.2 ± 16.3 per 1 mm Hg decrease in SBP; $60 ± 228.4 per 1 mm Hg decrease in DBP; $665.2 ± 265.2 to help 1 more patient achieve BP control; $463.3 ± 110.7 to help 1 more patient achieve good refill adherence; decrease in SBP and DBP compared with control; increase in percentage of patients achieving BP control; increase in percentage

Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
						of patients achieving good refill adherence; decrease in time of pharmacist-patient encounter compared with previous studies
Houle SKD, Rosenthal MM, Tsuyuki RT	2014	Case study	Description of 2 successful implementations of progressive technician facilitation of pharmacist's patient care activities in the community	Admin duties: appointment scheduling; transcribing care notes into reports for communication to other health professionals; drawing up injections for flu clinics or travel medicine consultations; completing a medication history; identifying patients for pharmacist consultation; collating dispensing records and lab results before rounds; checking Rx prepared by other techs; in-store marketing of vaccine services; phone high-risk patients to book vaccine appointments; coordinate onsite clinics with retirement homes; inventory, billing, and documentation	Regulated pharmacy technician; selected due to experience, conscientiousness, and willingness to expand role; mutual trust between pharmacist and tech led to expansion of roles	Greater professional satisfaction; greater pharmacy efficiency with reduced duplication of effort; pharmacist could focus more time on activities requiring clinical expertise; greater capacity for billable services
Svarstad BL, Kotchen JM, Shireman TI, Brown RL, et al.	2013	Quantitative	Refill adherence rates and changes in systolic and diastolic BP and proportion of patients achieving BP <140/90 mm Hg	Calling and reminding patients; printing Rx profiles; setting up table and chairs; using an automatic monitor to measure BPs; administering patient self-report tools	8 hours of training (1 h self-study, 7 h joint workshop); assist the pharmacists in making and confirming appointments; setting up a semiprivate BP counseling station; measuring BPs; collecting previsit tools completed by patients	Increase in refill adherence rate during intervention; decrease in SBP and DBP, and increase in BP control during intervention; increase in refill adherence rate after intervention; lower SBP and greater SBP reduction after intervention; patients had higher level of adherence monitoring and support by their pharmacists
Reed M, Thomley S, Ludwig B, Rough S	2011	Case study	Describe a tech-check-tech program created and implemented at an academic medical center	A technician role called a "Validated Pharmacist Assistant" to perform checking functions, commonly "tech-check-tech"	6 months' experience or PTCB; in-house self-learning packet (must score ≥90% on a written exam covering material); practical training with pharmacist oversight (must complete ≥24 hours of practical training); validation: must attain ≥99.8% accuracy rate for ≥2500 consecutive doses checked during ≥5 separate audits over ≥5	Pharmacist still performs a final check on 10% of doses; 90% of pharmacists agreed that they had more time for patient care activities and reduced drug distribution workload; 82% of pharmacists agreed that the program improved their overall job satisfaction; reduction in time spent checking cart fill from 6 hours 5 minutes per

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Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
					separate days; errors introduced at <0.2% (<5 out of every 2500 doses)	day to 20 minutes per day
Pattin AJ, Powers MF, Lengel AJ	2011	Quantitative	Describe a training program for pharmacy technicians about their role in the MTM process	Nonclinical role in MTM process; identify eligible patients; schedule appointments	2-hour live session: Powerpoint presentations; review of an MTM manual (instructions on how to log into different software systems); schedule patient appointments; perform other functions; pre- and post-survey	Increase in number of techs who thought they could perform MTM services after completing the training program (statistically significant); increase in number of techs who thought that MTM services are important for customers (not statistically significant); increase in number of techs who strongly agreed that technicians can help pharmacists perform MTM services (statistically significant); techs excused from work and paid hourly rate to attend training
McKee J, Zimmerman M	2011	Quantitative	Development and implementation of tech-check-tech	Advanced Practice Pharmacy Technician to check unit doses prepared by other technicians ("tech-check-tech")	Certified with 1 year's equivalent experience in unit dose filling; didactic training (self-learning packet); competency assessment (100% accuracy rate for each annual audit; audit: 500 line items in the cart fill and 100 line items in the automation refill process)	Pharmacist time saved, allowing for more clinical services to be implemented; elimination of a 0.5 FTE pharmacist position; savings of $83,576 of pharmacist salary; increase in compensation for technician (5%); increased job satisfaction; peer recognition; taking ownership of expanded roles
Friesner DL, Scott DM	2010	Quantitative	Identify aspects of technicians' experience, training, practice setting, and location that influence roles	Compounding oral medications; compounding topical medications; preparing 3rd-party billing; refill requests; obtaining medication history; ordering stock; taking new prescriptions over the phone; counseling patients on OTC medications	Certified; 1-year training program (technical degree); 2-year training program (associate degree); Pharmacist-Assisted Technician Self-Instruction Module	Certified techs more likely to compound topical medications; certified techs more likely to request refill authorizations
van den Bemt PMLA, van den Broek S, van Nunen AK, Harbers JBM, et al.	2009	Quantitative	Frequency of medication and allergy discrepancies before and after implementation of medication reconciliation	Medication history; medication reconciliation; allergy history; prepare a recommendation on antithrombotic for anesthesiologist; delivery of reconciled medication list, allergies, and advice on antithrombotic to anesthesiologist	Communication skills; definitions of allergic reactions; general pharmacotherapy; pharmacotherapy of anticoagulants	Decrease in patients with ≥1 medication discrepancies
Mark SM, Saenz R, Yourich BE, Weber RJ	2008	Qualitative	Overview of how the role of a technician can be incorporated into	Order entry; clinical data collection; profile reviews; medication reconciliation; deliver	Certified; training in ≥4 of the 6 existing pharmacy department areas; acceptable	Decrease in turn-around time; increased nursing satisfaction scores with pharmacy

Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
			the pharmaceutical care process	meds to nurse; establish relationships with nurses; answer phone calls from patient care providers; resolve missing medication doses; discharge medication counseling preparation; medication drip rounds; emergency/ code support; follow-up on charting omissions; narcotic surveillance and use of dispensing cabinets; drug use and compliance reporting; adverse drug reaction and error surveillance	customer service ratings on previous evaluations; order entry; 2 weeks of unit-based training: 1 week with technician (customer service training program; observational component of technician interaction with nurses); 1 week with pharmacist	
Scott DM, Halvorson D	2007	Quantitative	Evaluation of the wages, benefits, and responsibilities of pharmacy technicians	Pharmacy technician in North Dakota	Certified; 1-year training program (technical degree); 2-year training program (associate degree); Pharmacist-Assisted Technician Self-Instruction Module (PATSIM)	Grandfathered technicians had the highest hourly rate followed by 1-year graduates, 2-year graduates, and PATSIM graduates; grandfathered technicians had the highest gross salary followed by 1-year, PATSIM, and 2-year graduates; higher hourly rate for certified technicians
Read H, Ladds S, Rhodes B, Brown D, Portlock J	2007	Quantitative	Assessment of patient understanding of support medications: baseline and second measurement	Drug history; drug interactions; whether supplies of support medications were required	Accredited medicines management course (private study; study days; competence in work-based activities in a written portfolio; OSCE); directed study on patient counseling, chemotherapy regimens for breast cancer, support medications, identification of side effects, drug interactions, written examination, assessment of counseling skills through in-practice observation	Decrease in patients with chemotherapy delays; decrease in patients experiencing chemotherapy dose reductions; decrease in support medications required; decrease in pharmacy time to dispense; decrease in mean cost of items supplied to patients; decrease in technician time; cost of training program; decrease in pharmacy time per patient resolving Rx issues; patients rated their level of understanding of support medications higher
Rose D, Evans SW, Williams R	2005	Case study	Describe the implementation of a technician discharge transcribing service	Technician responsible for transcribing discharge prescriptions	3 years' post-qualification experience; MTO2 grade or above; qualified accredited checking technician; qualified medicines management technician; academic tutorial (read 2 standard operation	Save doctor hours; decrease in turn-around time; fewer errors than when doctors wrote the orders

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Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
					procedures; sign indicating they understand process; read and understand the Trust's safe prescribing procedure); supervised transcribing (transcribe 100 items and assessed: can make 1 minor but no major errors); audited regularly	
Hilaire ML, Powers MF, Kit MJ	2004	Quantitative	Develop a structured training module for technicians to enhance training for technical aspects of BG meters	Providing technical assistance with BG meters	3-hour live training session (technical aspects of BG meters; information component; hands-on experience); pre-training survey; post-training survey; provided a manual as a reference	Techs were paid for time in training; confident they could help with technical questions; improved knowledge regarding meters
Zillich AJ, Aquilino ML, Farris KB	2004	Quantitative	Knowledge and attitudes of technicians before and after attending a smoking cessation program	Promotion of smoking cessation interventions	2-hour course (tobacco-related health statistics; nicotine dependence; stages of behavioral change model; available smoking cessation pharmacotherapies; clinical practice guidelines); pre-training survey; post-training survey	Improved knowledge regarding smoking cessation; increased confidence to discuss smoking cessation; increased perception of how smoking cessation counseling would affect abstinence
Burnett D, Dooley MJ, Wall D	2003	Case study	Develop technician involvement in the manufacture of cell-based therapies for the treatment of cancer	Qualified cell-processing technologists	Aseptic chemotherapy preparation experience; didactic education; formal training (production of antibody-primed autologous macrophage-activated killer cells; didactic sessions (5 days); supervised activities; recognizing specific cells; washing and culturing cells; addition of stimulating drugs to activate cells); validation: demonstrate competence in compliance to standard operating procedures (gowning, washing, gloving, aseptic technique)	Increased workload for pharmacists and technicians while techs attended training; expansion of service to allow hiring of additional tech; advanced knowledge and skills; development of a 6-tier pay structure; additional salary
Hobson J	2003	Case study	Describe the implementation of an anticoagulant service technician	Anticoagulant service technician: accurately interpret INR results; calculate dose adjustments; counsel patients about their anticoagulant; answer patient queries; assist in the recall of patients who fail to attend; assist in service audits	In-house teaching packs, 6 hours/pack (hemostasis; pulmonary embolism; pharmacology and drug interactions; cardiac conditions; deep venous thrombosis; thrombophilia); reading list; list of tasks and activities; 2-hour tutorial after each pack;	Job satisfaction; patients have additional time with pharmacy staff; saved ~25 hours of pharmacist time per week

Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
					formal assessment: role-playing test, shadow staff in clinic setting, competence (had to dose 50 consecutive patients)	
Ambrose PJ, Saya FG, Lovett LT, Tan S, et al.	2002	Quantitative	Accuracy of trained technicians checking unit dose medication cassettes	Trained technicians to check unit dose medication cassettes filled by other technicians ("tech-check-tech")	6 months' experience filling unit dose medication cassettes; didactic training (lectures on unit dose process, proper packaging and repackaging techniques, medication safety, basic pharmaceutical calculations, written exam [had to achieve ≥80%]); practical training (observing a pharmacist checking cassettes; hands-on experience); audited for 3500 doses: had to have ≥99.8% accuracy rate, monthly audits of ≥500 doses	Save pharmacist time; pharmacists report increase in job satisfaction
Leversha A, Ahlgren KL, Gray MJ	2001	Mixed methods	Impact on patient care and pharmacy staff	Identify patients admitted in past 24 hours; obtain a photocopy of drug therapy chart; interview patient about medication supplies; inform patient of pharmacy discharge procedure; take drug therapy chart and patient's medications to pharmacy for verification; record on pharmacy computer that patient's medication is stored in pharmacy; ensure supply of medications required in ward; complete referral forms for patients with questions for pharmacist	Training session to identify issues related to their encounter with patients and information to provide to patient about hospital pharmacy's role	Address admission medication issues promptly; ensure that tech referrals were followed up on day of request; increase in number of patients seen by pharmacy staff within 24 hours of admission; decrease in medications that are needed to be supplied on discharge; cost savings of $1.22 per patient on discharge medications; pharmacists able to address clinical issues quicker; discharge medications processed more efficiently; increase in technician job satisfaction
Koch KE, Weeks A	1998	Case study	Justification for and impact of 2 clinical technicians	Clinical technician: collect lab data, screen patients, track outcomes; clinical administrative assistant: secretarial services, manage administrative portions of clinical pharmacy projects	Hospital technician training program (6 months); basic training in pharmacy math, pharmacology, overall explanation of each clinical program and tech's role; reading materials; made rounds with pharmacists; competence assessment	Improved work schedule; expanded responsibilities; salary increase: 9%; save pharmacist time: extra 8 hours of clinical time each day, 1–2 hours of documentation; improved tracking enhancing the measurement of the pharmacists' time and impact
Ness JE, Sullivan SD, Stergachis A	1994	Quantitative	Error rates and types of errors	Trained technicians to check unit dose medication drawers filled by other	Certification + 1 year inpatient experience, completion of a training program (general skills	Implied costs of additional training; benefits of replacing

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Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
				technicians ("tech-check-tech")	exam, introductory session on study, comprehensive session supported by a training manual, general introdution to unit dose distribution systems, exam covering material, minimum accuracy in checking)	verification pharmacists with techs
Raehl CL, Pitterle ME, Bond CA	1992	Mixed methods	Clinical pharmacy services' relationship to the use of technicians	Filling unit dose carts; filling orders for floor stock; managing control drug inventory were listed as higher function roles	6 states required some in-service training; 5 states required high school graduation; 4 states required 3 months of on-the-job training; 3 states required techs to meet institutional requirements	Increased use of pharmacy technicians was associated with increased involvement by pharmacists in patient-specific clinical pharmacy services; association between higher technician use and higher technician salaries
Spooner SH, Britton ME, Erskine LM, Verschoor BA, et al.	1991	Mixed methods	Evaluation of support and process for expanding tech roles	Expanded dispensing; checking unit-dose carts; front counter scheduling; total parenteral nutrition order entry; expanded decentralized roles: filling prescriptions, compounding, dispensing and inventorying narcotics, front counter scheduling, manufacturing of central venous nutrition, peripheral venous nutrition, large-volume sterile solutions, analgesic syringes; scheduling manufacture of large-volume sterile solutions; packaging and dispensing dyes for radiology; management roles	Technicians train technicians; entry-level training tied to core competencies; certain technician jobs would require a higher level of competency with training; job rotation	Reassigning technical tasks (savings of $237.60/day if switch tasks from pharmacists to technicians; savings of 23.76 h/day if switch tasks from pharmacists to technicians); cost of technician turnover of $1500/technician (savings of $1166.67 of training costs/mo); addition of 712.8 h/mo of pharmacist time; improved job satisfaction; cost of implementing would be 4.16 additional technician FTEs; cost to train, supervise, and coordinate tech functions
Phillips CS, Ryan MR, Roberts KB	1988	Quantitative	Current roles, future roles, preference of training and tech recognition	Supportive activities more frequently delegated than dispensing	Self-study correspondence program; community college based; formal in-house training; college of pharmacy–based program; formal training at another pharmacy; informal on-the-job training	Implied delegation of additional activities to technicians to save pharmacist time; prefer formal in-house training programs 1st followed by programs at colleges of pharmacy
Fillmore AD, Schneider PJ, Bourret JA, Caswell RJ	1986	Quantitative	Cost to train	Drug administration	9-week training program: 4 phases	$12,277 for phase 1 training; $16,903 for phase 2 training; $20,382 for phase 3 training; $33,900 for phase 4 training; $1783 cost for personal acquisition; $5683 cost per trainee
Mahoney CD, Gallina JN, Jeffrey LP	1982	Case study	Descriptive	Liaison between pharmacy supervisor and supportive personnel; determining	600 hours' on-the-job training; classroom instruction in all aspects of pharmacy	Creation of a career ladder; recognition of performance; increased salary; increased

Table 1 (*continued*)

Author(s)	Year	Design	Objective(s) and outcome(s)	Advanced roles	Additional education	Costs/benefits identified
				priorities for established production procedures; training and continuing education programs for trainees and technicians	clinical services; advanced training program for specialized and more sophisticated assignments; continuing education programs	stability in position; increased job satisfaction
Hoffmann RP	1982	Quantitative	Tech utilization, training, roles, job requirements, salaries	Different "levels of technicians"	Different job qualification requirements; different levels of on-the-job training; typing ability and high school graduation most common qualification; high preference for proper phone etiquette; passage of a math quiz; knowledge of medication terms; background in math; hospital pharmacy experience	Highest salary for chief technician, lowest for data entry
Jeffrey LP, Mahoney CD	1975	Quantitative	Descriptive	Supervision of other supportive personnel; coordinate work assignments for other technicians; training of staff	Formal on-the-job training program (15 × 40-hour weeks)	Career ladder; increased salary; recognition
Miller DE, Kendall RW, Hynniman CE, et al.	1972	Mixed methods	Interest in expanded role and job satisfaction	Maintenance and repair of patient care equipment; maintaining operating room's supply; "purchase, preparation, and distribution of implants"	Mostly 1-on-1 training personalized based on individual support staff and scope of the new role to support the pharmacy operation; authors recommend the individualized training over formal training	Indirect benefits of career advancement or upward mobility

Abbreviations used: BG, blood glucose; BP, blood pressure; CMR, comprehensive medical review; DBP, diastolic blood pressure; DTP, drug therapy problem; FTE, full-time equivalence; MTM, medication therapy management; MTO2, medical technical officer grade 2; OSCE, observed structured clinical examination; OTC, over-the-counter; PDC, patient-delivered care; PTCB, Pharmacy Technician Certification Board; RASA, renin angiotensin system antagonists; SBP, systolic blood pressure.

Discussion

Roles

The role of the pharmacy technician was typically limited to one that does not require professional judgment, and this is supported by the ASHP statement identifying that advanced technicians are able to assist in the delivery of clinical services. The roles identified in the literature are consistent with technicians performing administrative positions, such as managing patient appointments[7,8,11-13,15,26] and pharmacy consultations,[8,29] administering patient self-report tools,[11,13] and billing and documentation of vaccine administration.[12] There is also support for using technicians to collect a comprehensive medication history[7,12,17,18,21,28] and to collect clinical data needed to appropriately dose and monitor medications,[8,12,19,29] but this information is reported to the pharmacist who then evaluates and makes a clinical recommendation to the health care team. Although this may be seen as advancement from the traditional dispensing roles, if the aim of pharmacy service is to provide patient care and optimize medication delivery, organizations should consider whether they are underutilizing technicians who are capable of performing more patient care activities.

Three articles identified roles in positions that require professional judgment. Read et al. discussed the use of a pharmacy technician–led outpatient breast cancer clinic,[21] and Hobson used technicians to dose warfarin in an outpatient anticoagulation clinic[26]; both studies were performed in the United Kingdom and reported favorable patient outcomes. The third study, conducted in a preoperative screening clinic in the Netherlands, used technicians to perform medication reconciliation and to prepare a recommendation for the anesthesiologist regarding discontinuance of any antithrombotic before surgery.[18] These studies support using technicians in clinical positions beyond data collection and may help to conceptualize additional advancement opportunities in the United States.

The literature also identified roles in which technicians used their experience to perform positions outside of the pharmacy. For example, Burnett et al. identified the use of

pharmacy technicians with experience in chemotherapy preparation as cell-processing technologists in the manufacture of cell-based therapies for the treatment of cancer,[25] and Fillmore et al. evaluated their use as drug-administration technicians.[34] Technicians can also serve a role in assisting patients with insurance and cost barriers.[7,9] Navigating the health care system can be an overwhelming and confusing task for patients. Technicians engaging in the navigation of these complexities can assist patients in obtaining medications that they otherwise would not have been able to receive. Gilbert and Gerzenshtein found that by integrating pharmacy technicians in an outpatient infectious disease clinic, they were able to assist patients in obtaining more than $700,000 from patient assistance programs.[9]

One area that appeared to be lacking in the literature was the use of pharmacy technicians in managerial or supervisory roles. The ASHP position statement supports the use of technicians in this capacity, but only 3 articles reviewed identified using technicians in a management role,[32,35,37] all of which were published before 2000. Those articles primarily used technicians to supervise other support staff[35,37] and to train new technicians[32,27]; none of the articles reviewed used technicians in formalized managerial or decision-making positions. The 2016 Law Review released by the National Association of Boards of Pharmacy identified that only 8 states require that at least 1 pharmacy technician serve as a member of the board of pharmacy,[39] limiting the impact they can have on the evolution of their role or the practice of pharmacy.

Training

Several articles identified that adequately trained pharmacy technicians can be used in a more extensive capacity, but what constitutes adequate training is still undecided. In contrast to the training requirements outlined by ASHP[1] and APhA,[2] common prerequisites for consideration for a position included certification[7-9,14,16,17,19,20,30] and a minimum amount of previous work experience.[12,14,16,17,20,22,27,30] Five of the articles[12,21,22,26,30] required technicians to have completed a formal educational program; however, 3 of those articles[21,22,26] were based in the United Kingdom, and 1 article[12] involved technicians in Alberta and British Columbia, Canada. Only 1 article[30] published in the United States required technicians to have completed a board of pharmacy–approved training program to be considered for the advanced role. None of the articles required technicians to complete an accredited technician training program.

In 1988, Phillips et al. surveyed pharmacists-in-charge in both community and institutional pharmacies in Tennessee and found that formal on-the-job training programs were the preferred method of training.[33] Although the content of each program differed according to the varying knowledge and skills required to perform the specialized roles, the results of that research were consistent with the results of several other studies, in which technicians were trained via an in-house didactic component,[7,10,11,13-16,18,21-27,29,30,34,35,37] supervised on-the-job training,[6-10,14,18,19,21,22,25-27,29,33-37] and a competency-based examination.[6-8,14,16,21,22,25-27,29,30] Although on-the-job training may be adequate in some cases, it is difficult to replicate and reproduce to ensure that knowledge and skills are transferable outside of the organization. Training provided by employers may focus on the needs of the organization and are potentially less likely to consider career enhancement as a primary outcome for the technician. In addition, practitioners providing the training may lack skills as educators, limiting the effectiveness of knowledge transfer.

Cost/benefit

Several costs to either the pharmacy department or the individual technician must be weighed against the potential benefits of advancing the role of the technician. One such cost is the training program.[21,30,32,34] Depending on the complexity of the new role, the training required and the subsequent cost will vary. Fillmore et al. identified in 1986 that the cost to the pharmacy department to train 1 pharmacy technician to perform a drug administration role would be $5683,[34] and Read et al. in 2007 reported a training cost of £1955 to prepare a technician to lead an outpatient clinic for breast cancer patients.[21] Few articles evaluated the full costs of advanced technician training or whether the technician should be responsible for a proportion of the costs.

Scott and Halverson in 2007 evaluated the salaries of pharmacy technicians in North Dakota and compared the level of training with the reported salary. They found that grandfathered technicians with no formal training reported the highest salaries at $13.11/hour compared with technicians who completed either a 1-year certificate program or a 2-year Associate in Applied Science degree. Marginal increases ($0.10 to $0.30/hour) were associated with each level of training if the technician became certified. These results imply that work experience and tenure with an employer have the greatest impact on salary, not the level of formalized training completed.[20]

The APhA statement encourages the development of compensation models that promote sustainable career opportunities.[2] However, the trend appeared to focus on benefits resulting from an increase in pharmacist time[8,12,14,16,19,26-30,32,33] resulting in an expansion of services,[25,29] greater pharmacy efficiency,[7,8,11,12,19,21,22,28,29] and improved patient outcomes.[7,11,13,18,22,28] An increase in salary was identified in only 7 of the articles reviewed,[6,16,25,29,35-37] and only 2 articles monetized the increase, 1 with a 5%[16] and the other a 9%[29] increase. Nonmonetary benefits were identified, such as an increase in job satisfaction,[12,16,26,28,32,35] a more desirable work schedule,[29] and increasing the knowledge base of technicians.[15,23,29] These incentives may offer additional motivation for current technicians to learn and grow but may not be a strong incentive to recruit the best employees into the field or to support a longer career plan with a stable financial trajectory.

Consideration for technician advancement could follow the path of other allied health technologists and technicians. For example, dietetic technicians must either complete an accredited program or obtain a bachelor degree and pass a national credentialing examination.[40] Technicians are then able to obtain additional certifications to allow them to advance their career. Another example is dental hygienists. According to the American Dental Association, dental hygienists are required to obtain an associate degree from an accredited program, pass a licensing examination, and receive a license from their individual state board. Hygienists then

have the opportunity to further their education by obtaining bachelor and master degrees,[41] and in 2005 the American Dental Hygienists' Association recommended the creation of a doctorate in dental hygiene to further advance the profession.[42] These and other allied health professions provide a potential outline for a path forward to advance the role of the pharmacy technician.

Limitations

One limitation of the present study is the differing titles that have been or are currently used for pharmacy technicians. The titles "pharmacy technician" and "pharmacy technologist," which are commonly used today, were included as search terms; however, older titles such as "pharmacy assistant" or "pharmacy supportive personnel" were not included in the search. In addition, the search was limited to published literature, excluding potential results found in "gray" literature.

The abundance of papers reporting on-the-job training as the primary mode of knowledge transfer to teach advanced roles creates a potential for information bias. Supervised on-the-job training may have significant variation in its implementation, limiting the ability to compare across sites or reproduce in different settings. Some on-the-job training may be inadequate to prepare technicians for an advanced role, but with limited information published by authors about the specifics of the training, we were forced to categorize in 1 group with the potential for significant heterogeneity of exposure. Because we were not attempting a meta-analysis with this review, we thought that inclusion would provide value of a descriptive nature. Additional information bias may derive from categorizing costs and benefits where multiple stakeholders exist. For example, costs or benefits may be experienced by both the pharmacy and the individual technician. This limited our ability to perform any economic analysis of the findings.

Another limitation of this study is the differing state requirements for an entry-level position. The aim of this study was not to determine the requirements of each state to become a technician; however, this could affect the level of training or education of a technician involved in the studies, which may have affected his or her ability or the comfort level of the pharmacist with allowing the technician to take on a certain role. In addition, the differing state laws and regulations may limit the roles that a pharmacy technician is legally allowed to perform. Obtaining board approval to study a technician's performance in a certain position may have hindered the evaluation of certain roles. In addition to interstate differences, there are also intercountry differences that may affect the advancement opportunities of technicians.

Conclusion

Although the literature supports that technicians are capable of performing advanced roles in the pharmacy, resulting in either improved patient outcomes or opportunities for pharmacists to engage in additional clinical services, the benefits to the technician were primarily indirect, such as an increase in job satisfaction or a more desirable work schedule. If a technician is to take on additional roles that require completion of a formalized training or educational program, benefits that are more tangible may help to inspire more technicians to pursue these roles.

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